ASSOCIATION OF
FEDERAL COMMUNICATIONS CONSULTING ENGINEERS
WASHINGTON, D.C.

November 20, 1995

Mr. William Caton, Acting Secretary
Federal Communications Commission
1919 M Street, NW
Washington, DC 20554

RE: MM Docket No. 87-268

Dear Mr. Caton:

Transmitted herewith for filing with the FCC are the originals and nine copies of the comments of AFCCE in the above referenced matter.

If any questions arise in this matter, please contact the undersigned.

Sincerely,

Carl T. Jones, Jr., AFCCE President
c/o: Carl T. Jones Corporation
7901 Yarnwood Court
Springfield, VA 22153

CTJ:jmm

Enclosures

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
Advanced Television Systems	)	
and Their Impact Upon the	)	MM Docket No. 87-268
Existing Television Broadcast	)	
Service	)	

FOURTH FURTHER NOTICE OF PROPOSED RULE MAKING
AND
THIRD NOTICE OF INQUIRY

COMMENTS OF THE ASSOCIATION OF
FEDERAL COMMUNICATIONS CONSULTING ENGINEERS

These comments on the Fourth Notice of Proposed Rule Making and Third Notice of Inquiry (Fourth NPRM) in the above captioned matter are submitted on behalf of the Association of Federal Communications Consulting Engineers (AFCCE). AFCCE is a professional organization whose members are professional engineers practicing as consultants to broadcasters and other segments of the communications industry, communications company engineering executives, representatives of equipment manufacturers and others working in the communications arena. AFCCE has a long history of participation in FCC rule making proceedings dating back to its founding nearly fifty years ago and welcomes this opportunity to submit its Comments to the Commission.

In order to properly address the issues raised in the Fourth NPRM, AFCCE formed an Ad Hoc Committee composed of 10 association members who are representative of a broad cross-section of the broadcast industry including consulting engineers, broadcasting group operators, manufacturers and communications tower owners. As AFCCE is primarily a technical/engineering organization, it has elected to limit its comments to those aspects of the NPRM

which deal with technical issues. In particular, AFCCE wishes to comment on the following matters:

- Planning Factors
- Quantification of ATV Coverage
- Receiver Standards
- Transition Period
- Spectrum Recovery

Planning Factors

AFCCE is cognizant of the Commission's intent to issue a proposed allotment table as part of a forthcoming further notice of proposed rule making. It is concerned, however, that such a table of allotments must be based on a set of planning factors which have not yet been officially adopted nor has adequate data been available until recently to permit such an adoption. Among the issues which need to be addressed and which may not have been adequately explored are:

- The time availability of the ATV signal, currently assumed to be 90% in the Grand Alliance documents, is probably not an appropriate assumption for it implies that there is a probability of no service 10% of the time. This is a quite different concept than used in the present NTSC service where, for example, Grade B coverage means that the best 50% of the locations bounded by the appropriate field strength contours will receive acceptable service at least 90% of the time; if the field strength is less than the desired value it could mean that a slightly degraded picture -- still usable -- would be available for a large percentage of the locations. In other words, it does not necessarily imply lack of service. With digital transmission, it does, of course, mean lack of service because of the well known and understood cliff-edge effects when digital signal levels are at or below the receiver threshold. AFCCE believes a higher availability assumption is required and its discussions with member engineers produced recommendations ranging from 95% to 99%. AFCCE is not, at this time, prepared to recommend

a specific value for this planning factor parameter but suggests that the Commission seek further comment from the industry after careful study of the recently completed field testing[1/]. The public reaction to a lost ATV picture 10% of the time cannot be expected to be comparable to that of reaction to a decrease in NTSC picture signal-to-noise ratio.

- Any adjustment to this availability value may require a change in other assumptions including receiver noise figure, receiving antenna gain and/or transmitter power.

  For example, should the planning factors be based on an assumption of the use of a low noise (pre)amplifier or LNA at the receiving antenna terminals or a higher ERP or both?

- If a higher ERP is used to provide a higher availability assumption, how will this affect the allotment table interference considerations particularly during the transition period (ATV interference to NTSC)?

- If an LNA is employed as a planning factor assumption, it will partially mitigate another factor which has not been adequately addressed to date. The current planning factor information is based on the use of a geometric mean frequency for derivation of receiving system antenna performance and transmission line (downlead) loss; an LNA will eliminate the downlead loss concern. While a receiving antenna power "gain" can be assumed to be uniform across the UHF band, the "dipole factor" cannot. This factor, which describes ratio of the voltage at the terminals of an antenna relative to the field strength of the signal it is receiving (in volts per unit length, e.g., mV/m) is, of course, frequency dependent. From Channel 14 (best) to Channel 69 (worst) the spread approaches 5 dB which can be restated to mean that the ERP at Channel 69 will have to be three times greater than for Channel 14 for parity in reception robustness. In the NTSC service, as noted above, the difference translates to signal-to-noise effects; in the ATV system, it will clearly translate to the difference

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[1/] The report of the field testing was not available in time to be adequately considered by AFCCE for the instant proceeding.

between service and no service[2/]. Stations with equal facilities (ERP/HAAT) on low UHF and high UHF will not provide equal services since the high UHF facility may have an available "fade" margin which is 4-5 dB less than its low channel neighbor.

- The proposition that *reliable* UHF-HDTV service can be made available beyond the line-of-sight with practical transmitters and antennas and without causing undesirable side-effects in existing receivers is, at best, an untested hypothesis. The FCC propagation curves as well as all the publicly available propagation models are based on a single, narrow-band carrier. The applicability of the single-carrier models to broadband, digital HDTV, propagation is not known. While the FCC curves may be reasonably assumed to be broadband within the line-of sight contour, extending this assumption to the shadowed area beyond the horizon is unwarranted at this time.

- Perhaps, especially during the transition years, when both HDTV and NTSC are operational, the area bounded by the line-of-sight "contour" could be established as the primary UHF-HDTV service area. This primary service area could be further defined as the area where the reliability of the UHF-HDTV signal is high, with time availability near 99% for service comparability with NTSC. Extension of such service may require the inclusion of an LNA in those receive antennas located near and beyond the radio horizon. The inclusion of an LNA as part of a TV receive antenna has already been implemented in DBS dishes without objection. There is no allowance for an LNA in the planning factors proposed by ACATS.

With the use of appropriate planning factors, service reliability and channel parity could be improved. Transmitter sizes could be kept at a practical level and overloading of existing receivers avoided. AFCCE is prepared, if requested by the FCC, to provide a complete mathematical description of the receiver model and planning factors outlined in this brief.

[2/] AS noted in the following section on coverage, the concept of field strength may be meaningless in ATV.

Quantification of ATV Coverage

A review of literature, reports and comments of various parties to this proceeding and in other forums reveals a lack of consensus on the definition of coverage and methodologies for determining or quantifying the service area of an ATV station. While the Commission's oft-stated goals of equivalent service or matching the service area of a station's NTSC facility with its ATV facility are lofty objectives, guidance on how to determine equivalency is lacking.

For the NTSC system, the Commission adopted sets of planning factors for the various grades of service for each band (low band VHF, high band VHF and UHF). Using the F(50,50) curves for desired signal propagation and the F(50,10) curves for interfering signals, the grades of service (A, B and Principal City) were established. These curves, assembled from a combination of empirical data and theoretically derived values, predicted field strengths for given location and time variability factors [F(L,T)]; the F(50,50) values were adjusted for L,T to yield the required field strength for an acceptable signal for each grade of service [Grade A: F(70,90); Grade B: F(50,90); Principal City: F(90,90)]. Thus, the higher the field strength the greater the probability that an acceptable signal would be delivered to viewers.

However, in this analog world, service does not end at the Grade B contour. Rather a lesser quality signal would be available, at least for VHF stations, beyond the line-of-sight contour. It was fairly straightforward then to predict the locii of the service contours by determining field strength from the curves or by actual measurements. These principles do not apply to the digital realm of ATV. While AFCCE addressed above its concerns regarding the time availability factor of 90% (which appears to be becoming a de facto assumption for ATV), we believe that it would be appropriate to further explore the differences between digital and NTSC signals which may render the traditional concepts of coverage and service area measurement inappropriate for the ATV service.

The NTSC signal power is concentrated at the visual carrier frequency and the peak value of (visual) transmitted power is a constant which occurs at synchronizing pulse tip. Field strength can be measured on a test set comprised of an antenna of known characteristics and a calibrated RF voltmeter (field strength meter). In digital signal transmission, power is distributed randomly over the 6 MHz spectrum and there is no carrier or single frequency peak which can be used as a reference as in the analog NTSC system. Thus, references to field strength (a voltage per unit length usually expressed as milli- or microvolts per meter) as used in traditional analog systems must be replaced by the total power received (perhaps integrated over the 6 MHz spectrum of the TV channel or specified as a time averaged value for a specific bandwidth).

It is suggested, therefore, that in its next Notice of Inquiry, the Commission seek comments on the following questions:

- Should ATV service "contour" be specified in terms of spectral power density, e.g., $W/m^2/MHz$, or received power at the terminals of a reference antenna?
- What roles do the F(50,50) propagation curves have in predicting ATV received power, if any?
- What equipment and procedures should be used in measuring ATV power density or received power for the purpose of determining or verifying ATV service contours?

Receiver Standards

Critical to the implementation of the new ATV service, which is a completely new end-to-end system, is the performance of the receiver in an interference and multipath environment. That is, the receiver that the consumer purchases will represent <u>half</u> of the proposed ATV <u>system</u>. Under the auspices of the ACATS process and through very thorough testing at the Advanced Television

Test Center (ATTC) in Alexandria, Virginia, the Grand Alliance system prototype performance was measured. These measurements have been documented in the ACATS process and form the basis of the expected minimum end-to-end performance of the Grand Alliance System.

In determining the service area of the new digital system, regardless of the final planning factors adopted for the allotment process, it is these values, scientifically determined, that will be used for the final analysis of the expected service area. If the receiver manufacturers do not design their receivers to provide ATV interference and multipath performance equivalent to that of the Grand Alliance receiver, then predictions of expected ATV system performance cannot be assured to the consumer investing in the new ATV technology.

Therefore, AFCCE urges the Commission to adopt minimum ATV receiver standards with regard to interference, including RF and noise impairments. In addition, the adaptive equalization scheme used by manufacturers of ATV receivers should perform at least as well as the Grand Alliance prototype, as tested under the auspices of the ACATS. These minimum standards will assure that the half of the ATV system that the consumer purchases will meet the minimum service expectations demonstrated by the testing.

Minimum receiver standards for interference and multipath performance will not limit receiver manufacturers to a specific design or implementation. How the receiver manufacturer implements its design is still left largely to its ingenuity. Minimum standards will, however, protect both the public and broadcasters as they make this significant investment in this next generation of digital television.

AFCCE requests that the Commission include the development of ATV receiver standards in future Further Notice of Inquiry and Notice of Proposed Rule Making on ATV.

Transition Period

AFCCE believes that the six-year period proposed by the Commission for stations to implement their ATV service may be inadequate for the reasons discussed below.

- Industry Capacity. Assuming that some 1,600 television broadcast stations will have to purchase new transmitting equipment including antennas, transmission line, transmitter and input/monitoring equipment, and that, in the majority of cases, new supporting tower structures will be required, it is clear that the existing industry infrastructure does not have sufficient capacity to provide the hardware in a six year period. Actually, the time required for planning, and site acquisition/approvals (if necessary) will consume a significant portion of this six year period requiring vendors to produce and deliver their products in a much shorter time frame. AFCCE has informally discussed these industry capacity issues with major suppliers of transmitters, antennas, and towers. All agreed, without exception, that the six year period would be unreasonably short. If the general assumption that 50 to 60 percent of the tower structures will need to be replaced or require major structural modification is correct, the half-dozen companies in the U.S. that presently have the capability to design, fabricate and erect tall towers will be unable to meet the demand. AFCCE hopes that these and other suppliers will file comments in this proceeding which will provide the Commission with first-hand definitive data on the overall capacity of the industry. In the event that this is not the case, the Commission should undertake a detailed study and evaluation of the capacity before arbitrarily establishing what now appears to be an inappropriate time frame. A related issue may be the FCC-type acceptance of new transmitter equipment; if the Commission is not positioned to rapidly process and approve type acceptance requests, the supply time frame could be adversely affected.

- Broadcaster Construction. Perhaps the major "unknown" facing broadcasters at this time is the degree to which their present facilities can be modified to accommodate a second, ATV, transmission facility. High on the list of components of this issue has to be tower capacity to

> support a second antenna and wavequide or coaxial transmission line. It is clear that most TV stations do not have structures with such reserve capacity. Without a table of allotments and a specific channel assignment a broadcaster cannot begin to know what ERP (and, therefore, requirements for transmitter, antenna, and transmission line) will be required or even if its present site will meet separation and coverage criteria. There may be opportunities for broadcasters to colocate ATV services on a common site and, perhaps, even use common antennas. Acquiring such sites, overcoming zoning obstacles, obtaining FAA approvals, mitigating environmental concerns and negotiating purchase and cooperative agreements will take years in the typical situation. Thus, even if a station put its conversion project on a "fast-track", it is very likely that these processes combined with equipment acquisition and installation will require more than six years to complete. Some of these processes are iterative and failures to acquire sites or get approvals would require restarting the entire process.

Since neither accurate data on industry capacity nor the ramifications of the Commission's allotment table are known, it is difficult for AFCCE to recommend a specific construction time frame. However, a poll of its ATV Committee members indicated that a period of 10-12 years might be more appropriate than the proposed period of six years. Stations in smaller markets and public broadcasters may require additional time in order to assemble financing for this major undertaking. At a minimum, the Commission should grant "automatic" extensions of the deadline if a station's inability to comply is due to factors beyond its control (e.g., site availability or clearance problems, equipment delivery, etc.).

Spectrum Recovery

The Commission has indicated that it wishes to recover spectrum -- i.e., the spectrum presumed to be surrendered by broadcasters after the conversion to ATV is complete -- in contiguous blocks. It is apparent that there may not be

enough spectrum to accommodate all broadcasters with the assignment of an additional channel which provides equivalent coverage based on earlier Commission proposals and those of industry groups. Thus, it is likely that broadcasters, or a least most broadcasters, would be required to make two ATV "transitions": the first would be to an interim ATV channel during the NTSC "simulcast" period and the second to the final ATV assignment. The assumption is that the low-to-mid UHF spectrum would be most appropriately used for TV (ATV) broadcasting and that the higher UHF spectrum, if recovered, would be more appropriate for land mobile or personal communications uses. It is also assumed that the already known favorable interference characteristics of digital transmission (ATV-to-ATV) will permit very efficient use of the spectrum in the absence of NTSC system constraints.

Conclusion

AFCCE supports the Commission's efforts to implement the new ATV service but urges that the implementation timetable be founded on practical considerations of industry capabilities and that its soon to be released allotment plan be founded on sound engineering principles and, in particular, on a set of planning factors which are based on appropriate consideration of digital transmission properties.

Respectfully submitted,

ASSOCIATION OF FEDERAL COMMUNICATIONS CONSULTING ENGINEERS

by Carl T. Jones, Jr. P.E.
President

John F.X. Browne, P.E.
Chairman, AFCCE ATV Committee

Dated: November 14, 1995